



Aalborg Universitet

AALBORG UNIVERSITY
DENMARK

Cross-cultural adaptation of the Danish version of the Big Five Inventory - a dual-panel approach

Palsson, Thorvaldur Skuli; Christensen, Steffan Wittrup McPhee; Pape, Morten Haugaard; Hirata, Rogerio Pessoto; Rafn, Trine; Skou, Søren T

Published in:
Scandinavian Journal of Pain

DOI (link to publication from Publisher):
[10.1515/sjpain-2019-0066](https://doi.org/10.1515/sjpain-2019-0066)

Publication date:
2020

Document Version
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

Citation for published version (APA):
Palsson, T. S., Christensen, S. W. M., Pape, M. H., Hirata, R. P., Rafn, T., & Skou, S. T. (2020). Cross-cultural adaptation of the Danish version of the Big Five Inventory - a dual-panel approach. *Scandinavian Journal of Pain*, 20(2), 397-406. <https://doi.org/10.1515/sjpain-2019-0066>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal -

Take down policy

If you believe that this document breaches copyright please contact us at vbn@aub.aau.dk providing details, and we will remove access to the work immediately and investigate your claim.

Original experimental

Thorvaldur Skuli Palsson*, Steffan Wittrup McPhee Christensen, Morten Haugaard Pape, Rogerio Pessoto Hirata, Trine Rafn and Søren T. Skou

Cross-cultural adaptation of the Danish version of the Big Five Inventory – a dual-panel approach

<https://doi.org/10.1515/sjpain-2019-0066>

Received April 25, 2019; revised October 4, 2019; accepted October 17, 2019; previously published online December 3, 2019

Abstract

Background and aims: Assessing personality in research can be of importance, especially due to the potential relationship between different personality traits and the manifestation of symptoms in different clinical conditions. Therefore, it is important to have valid and reliable tools that allow for the assessment of personality traits. In this study, the aim was to translate and culturally adapt the Big Five Inventory (BFI) to the Danish language.

Methods: A dual panel approach, consisting of a 4-person bilingual panel and an 8-person panel with laymen, was used to translate and culturally adapt the questionnaire. A third 9-person panel consisting of people with different medical diagnosis was used to assess the face validity. Internal consistency (Cronbach's α) and test-retest reliability (intraclass correlation coefficients (ICC)) were tested amongst 96 subjects.

Results: The translated version demonstrated adequate internal consistency (0.66–0.84) and good-excellent test-retest reliability (0.86–0.95). The smallest detectable change is between 1.13–1.70 for the five subscales. Both

the healthy and patient panels of laymen considered the questionnaire too long.

Conclusion: This translated version of the Big Five Inventory demonstrated high to very high test-retest reliability and, for most parts, an acceptable internal consistency. The construct validity was however different from versions translated into languages geographically and culturally similar to Danish.

Implications: Assessing the Big Five personality traits in Danish populations can be valuable for many reasons, e.g. when assessing people in pain in both clinical and experimental settings. Improved knowledge of the underlying driver of pain conditions is important. Here, understanding how personality may interact with pain can help researchers and clinicians.

Keywords: personality assessment; dual panel translation; cultural adaptation.

1 Introduction

The coping strategies people use to deal with challenging experiences of daily life with regards to physical or emotional health may be related to personality [1–3]. Personality can be difficult to describe or define but is most often investigated through the lens of how an individual interprets and interacts with the environment [4]. Personality is commonly divided into specific personality traits and during recent years, focus has been on five general traits: extraversion, agreeableness, conscientiousness, neuroticism and openness [5]. Together, these five personality traits are referred to as the Big Five [6].

Recently, there has been a growing interest in studying personality, on its own and in relation to clinical conditions. From a clinical and research perspective, it is relevant to study and monitor how and if personality changes with progressive diseases affecting cognition such as Alzheimer's disease [7] and how personality traits can interact with other clinical conditions such as various pain conditions [8–10] and damage to the nervous system [11, 12].

*Corresponding author: Thorvaldur Skuli Palsson, Department of Health Science and Technology, SMI, Aalborg University, Fredrik Bajers Vej 7, Aalborg, Denmark, Phone: +453-022-0937, E-mail: tsp@hst.aau.dk

Steffan Wittrup McPhee Christensen: Department of Health Science and Technology, SMI, Aalborg University, Aalborg, Denmark; and Department of Physiotherapy, University College of Northern Denmark, Aalborg, Denmark

Morten Haugaard Pape: FysioDanmark Odense, Odense, Denmark

Rogerio Pessoto Hirata and Trine Rafn: Department of Health Science and Technology, SMI, Aalborg University, Aalborg, Denmark

Søren T. Skou: Research Unit for Musculoskeletal Function and Physiotherapy, Department of Sports Science and Clinical Biomechanics, University of Southern Denmark, Odense M, Denmark; and Department of Physiotherapy and Occupational Therapy, Næstved-Slagelse-Ringsted Hospitals, Slagelse, Denmark

In clinical pain conditions, it has been suggested that unhelpful pain behavior stems from an interaction between nociceptive processing, personality traits and the patient's context (social/physical environment) [13]. Likewise, pain catastrophizing and fear of pain seem to correlate with neuroticism [14, 15]. With this in mind and acknowledging that the prevalence of personality disorders seem to be high in chronic pain populations (see Weisberg [16]), it may seem important to include personality assessment into the clinical evaluation. Interestingly however, personality characteristics seem to change/improve with successful treatment across various pain conditions [17]. In fact, personality traits change over time in non-clinical populations [18] where the stability of personality seems to vary across different periods over the lifespan [19].

Many tools exist that can quantify the five personality traits, one of which is The Big Five Inventory (BFI) [20]. The BFI questionnaire is relatively brief (44 items in total) and is divided into five subscales, one for each of the five personality traits, and evaluates the responder on how well different short phrases apply to him/her. It has previously been found both valid and reliable [21, 22] in determining the five key personality traits in English and is available in a full version (44-items) and in other longer and shorter versions [23–25]. The questionnaire has been translated and validated in several languages, including languages with a similar geographic placement and culture e.g. Dutch [26], Italian [27], German [28] and Norwegian [29]. Moreover, the questionnaire has been tested simultaneously in 56 countries to investigate the questionnaire's conceptual equivalence across cultures by examining the scale reliability and factor structure [30]. The questionnaire has however not been translated validated and cross-culturally adapted into Danish.

The aim of this study was to translate and culturally adapt the BFI into Danish. Further, the study aimed at investigating the test-retest reliability, internal consistency, construct validity, standard error of the measurement (SEM) and smallest detectable change (SDC) of the questionnaire in a healthy asymptomatic population and the face and content validity in a clinical population.

2 Materials and methods

2.1 Design

This paper follows the guidelines for reporting reliability and agreement studies [31]. Using a multistep approach involving a centralized review process has been considered

an important factor for securing the best possible translation [32]. Therefore, the translation process was divided into three steps; a translation phase and then a two-step validation phase, which was evaluated by the group that performed the initial translation. Lastly, the test-retest reliability and internal consistency of the Danish version of the BFI was evaluated.

2.2 Ethical considerations

According to the Danish Act on Research Ethics Review of Health Research Projects, research that only involves interviews and questionnaires does not require approval by the Ethics Committee. Nevertheless, no sensitive personal data were collected in this study. The study was reported to the Danish Data Protection agency.

2.3 The Big Five Inventory

When filling out the questionnaire, the responder indicates how well he/she agrees with short statements by help of a 5-point Likert scale (1: Disagree strongly, 2: Disagree a little, 3: Neither agree nor disagree, 4: Agree a little and 5: Agree strongly). The total score is calculated for each of the five subscales which in turn consists of several items (Extroversion: 8 items, Agreeableness: 9 items Conscientiousness: 9 items, Neuroticism: 8 items and Openness: 10 items). For some of the questions, the score is reversed before calculating the final score [21].

2.4 Translation

The translation was performed using a dual-panel approach, following the recommendations by Swain-Verdier and colleagues [33]. The translation process was conducted by a bilingual panel (panel 1) and a panel consisting of laymen (panel 2). The bilingual panel consisted of 4 persons with fluent Danish and English language skills (Table 1). Members of the bilingual panel independently translated the English version of the BFI [21] into Danish before attending a consensus meeting led by one of the group members (TSP). During this meeting the translations were compared and if there was any disagreement regarding the translation, this was discussed until consensus was reached. This version of the questionnaire was then administered to a group of 8 laymen (panel 2; Table 1) who were asked to qualify the wording of the translated questionnaire with particular focus on whether the translation would be

Table 1: Demographic information portraying participants in panel 1 (top), panel 2 (middle) and panel 3 (bottom).

	Gender	Age	Occupation	Diagnosis
Panel 1	Male	35	Academia (PhD)	N/A
	Male	37	Academia (PhD)	N/A
	Male	38	Academia (PhD)	N/A
	Male	30	Academia (MSc)	N/A
Panel 2	Female	36	Administrative worker	N/A
	Male	33	Book keeping	N/A
	Male	36	Insurance broker	N/A
	Male	37	Medical doctor	N/A
	Male	66	Retired	N/A
	Female	65	Retired	N/A
	Male	65	Retired	N/A
	Male	46	Auto mechanic	N/A
	Male	46	Works with disabled	Multiple sclerosis
Panel 3	Male	44	Incapacity benefit	Hemiparesis after stroke
	Male	67	Retired	Psoriatic arthritis
	Male	84	Retired	Hemiparesis after stroke
	Male	52	Incapacity benefit	Multiple sclerosis
	Female	74	Retired	Osteoarthritis
	Male	61	Incapacity benefit	Syringomyelia
	Male	83	Retired	Hemiparesis after stroke
	Male	72	Retired	Chronic symptoms following meningitis

understood by laymen in clinical and non-clinical populations. Prior to reviewing the questionnaires, the purpose of the study was explained by one of the group members (MHP). After reviewing the questionnaire independently, the panel members participated in a focus group-interview led by MHP who, following the interview, reported any suggestions for alternate wording back to the leader of the bilingual panel (TSP). Lastly, the bilingual panel met again to discuss the suggestions put forwards by panel 2 and implemented as considered appropriate.

For the two panels involved in the translation process, it was assumed that the saturation of data could be obtained by using the proposed methods [34] and therefore, no formal power calculations were performed. Nevertheless, the study aimed at recruiting between 5 and 10 individuals for each panel in consistency to what previous studies with similar aims have done [35, 36].

2.5 Face validity

Although the main purpose of the Big Five Inventory is to quantify five different personality traits [21], there is growing interest in investigating whether specific traits could be related to clinical conditions [9, 10, 12]. With this in mind, a group of 9 persons undergoing rehabilitation for various clinical conditions reviewed and filled out the questionnaire independently (panel 3; Table 1). Subsequently, they participated in a focus group interview led

by MHP with the aim of recording any feedback regarding the questionnaire. The feedback from the interview was then reported back to the bilingual panel who integrated the suggested changes into the final version of the questionnaire as deemed appropriate.

2.6 Test-retest reliability, internal consistency and factor solution

Personality traits are likely to be stable in the short-term, while changes are likely to occur across the life span [37, 38]. To determine the reliability and internal consistency of the Danish version of the BFI, 100 people were asked to fill out the questionnaire with a 7-day time interval. A Principal Component Analysis (PCA) with a five-factor varimax rotation was performed to evaluate the construct validity i.e. how well the measured items (indicator variables) loaded onto the different subscales (constructs) of the questionnaire.

An a priori power calculation was not performed but this group size was estimated to be sufficient based on previous studies with similar aims [39, 40].

2.7 Analysis

To investigate the relationship between the individual items in each sub-scale and thereby internal consistency

of the questionnaire, the Cronbach's coefficient α level was determined for each of the five subscales. The coefficient ranges between 0 and 1, where numbers closer to 1 indicate a better relationship between each item within each respective subscale. Previously, it has been suggested that a correlation between 0.7 and 0.95 is acceptable [41–43]. In case some of the scales revealed α values lower than 0.7, an additional analysis was performed to determine whether any single item in the subscale was responsible for a low value.

To determine the reliability of the questionnaire (test-retest consistency), the Intraclass Correlation Coefficient (2.1) was calculated for each of the five subscales. Here, coefficients were considered low (0.26–0.49), moderate (0.50–0.69), high (0.70–0.89) and very high (0.90–1.00) [44]. To account for the difference between the two measurements and the systemic errors within the two measurements, the value of $SEM_{consistency}$ was derived by dividing the SD of the mean differences between two measurements ($SD_{difference}$) by $\sqrt{2}$, as recommended by de Vet et al. [45]. The smallest detectable change was calculated to determine the minimum change needed for the change to be considered a true change (i.e. not because of measurement error) [42]. For calculating the smallest detectable change, the following formula was used: Standard error of measurement $\times \sqrt{2} \times 1.96$ using Microsoft Excel 2016 (Microsoft Inc., Redmond WA, USA).

All statistical analyses were performed using SPSS® (IBM Corp. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY: IBM Corp).

3 Results

For the test-retest reliability, four individuals did not submit their questionnaires and therefore data from 96 individuals was available for data analysis. The demographic description of these people can be seen in Table 2.

3.1 Translations and face validity

Both panels provided feedback that resulted in changes in the final version of the translated questionnaire (Appendices i and ii). In general, the participants in both panels considered the questionnaire to be too long and were concerned that elderly people and persons in pain would struggle with filling out the questionnaire in one go.

3.2 Internal consistency, test-retest reliability and factor solution

The Cronbach's α ranged from 0.66–0.84. Only the value for the subscale *agreeableness* was below the desired cut-off value of 0.70 (Table 3). The removal of the first question in the scale (Tends to find fault with others [*Har tendens til at finde fejl hos andre*]) raised the α level to 0.71 (Table 4). For the test-retest reliability, the ICC-values were high to very high ranging from 0.86 to 0.95 (Table 2). The smallest detectable change ranged from 1.13 to 1.70 (Table 3).

Based on the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett's test of sphericity, the assumptions for performing a PCA were met (KMO: 0.659, Bartlett's: 0.000001). The five factors all had an eigenvalue above 1 (2.57–8.03) and the five factor solution explained 48.6% of the variance with factor loadings ranging from –0.067 to 0.843 with an average value of 0.443. Cross-loadings ranged from –0.465 to 0.843 with an average value of 0.039. Two of the sub-scales (*agreeableness* and *conscientiousness*) loaded primarily on the same factor (Appendix iii; Factor loadings above 0.3 are marked with bold as factor loadings below 0.3 are considered minimal [46]). Moreover, the sub-scale for *openness* loaded similarly on two factors.

Table 2: Demographic description of participants included for determining internal consistency and test-retest reliability.

	Educational level						Total
	Secondary school	Secondary education	Vocational education	Bachelor's degree	Master's degree	PhD	
Age mean years (SD)	57.6 (8.1)	38.2 (20.6)	46.2 (15.6)	38.9 (13.6)	40.5 (12.4)	41.6 (10.9)	41.7 (15.1)
Number of participants	9	15	6	28	32	6	96
Gender distribution (% female)	44	53	33	82	63	33	64

Table 3: Assessment of internal consistency (Cronbach's α), test-retest reliability (intraclass correlation), measurement error (standard error of measurement) and the minimum change needed for the change to be considered a true change (smallest detectable change).

Subscale	Big Five Inventory				
	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness
Time 1	27.8 ± 5.3	36.4 ± 4.6	35.0 ± 4.1	19.8 ± 5.4	34.0 ± 6.1
Mean ± SD score					
Time 2	28.4 ± 5.5	36.0 ± 3.6	35.3 ± 4.8	19.0 ± 5.6	34.4 ± 6.0
Mean ± SD score					
Difference (Time 2 – Time 1) ± SD difference	0.58 ± 2.48	–0.34 ± 2.86	0.25 ± 2.29	–0.84 ± 2.83	0.38 ± 2.64
Cronbach's α (95% CI)	0.84 (0.78–0.88)	0.66 (0.55–0.76)	0.75 (0.67–0.82)	0.84 (0.79–0.89)	0.77 (0.69–0.83)
Intraclass Correlation (95% CI)	0.94 ^a (0.92–0.96)	0.86 ^a (0.80–0.91)	0.94 ^a (0.91–0.96)	0.93 ^a (0.90–0.95)	0.95 ^a (0.92–0.97)
Standard error of measurement (SEM _{consistency})	1.75	2.02	1.62	2.0	1.87
Smallest detectable change	4.85	5.60	4.49	5.54	5.18

For the ICC's, ^aindicates significance at the 0.0001 level.

Table 4: Internal consistency (Cronbach's α) for the subscale “conscientiousness” in case any of the items is removed.

Question	Language	Statement	Cronbach's α if item is deleted
2	Danish	<i>Har tendens til at finde fejl hos andre</i>	0.71
	English	<i>Tends to find fault with others</i>	
7	Danish	<i>Er hjælpsom og ikke selvoptaget</i>	0.64
	English	<i>Is helpful and unselfish with others</i>	
12	Danish	<i>Starter skænderier med andre</i>	0.67
	English	<i>Starts quarrels with others</i>	
17	Danish	<i>Er tilgivende af natur</i>	0.64
	English	<i>Has a forgiving nature</i>	
22	Danish	<i>Generelt er tillidsfuld</i>	0.63
	English	<i>Is generally trusting</i>	
27	Danish	<i>Kan være kold og reserveret</i>	0.65
	English	<i>Can be cold and aloof</i>	
32	Danish	<i>Er hensynsfuld og venlig overfor næsten alle</i>	0.65
	English	<i>Is considerate and kind to almost everyone</i>	
37	Danish	<i>Er sommetider uhøflig overfor andre</i>	0.64
	English	<i>Is sometimes rude to others</i>	
42	Danish	<i>Kan lide at samarbejde med andre</i>	0.64
	English	<i>Likes to cooperate with others</i>	

By removing the first question from the subscale (*Har tendens til at finde fejl hos andre*) the Cronbach's α coefficient rises above 0.7. Removing the third question of the subscale (*Starter skænderier med andre*) increases the α level slightly. Removal of other items reduced the α coefficient.

4 Discussion

The Danish version of the Big Five Inventory is a face valid and reliable instrument to assess personality, with adequate internal consistency and high to very high test-retest reliability. The length of the Big Five Inventory is of concern, warranting translation of the short version of questionnaire to increase its feasibility and applicability in research and clinical practice.

4.1 The translation process and feedback

Using a dual panel process for translating questionnaires is advantageous, as it is preferred by laymen participating in the translation process without compromising the content or internal consistency as compared to the forward-backward translation method [47, 48]. Both panel 2 and panel 3 considered the questionnaire to be too long (Appendices i and ii). Moreover, panel 2 was concerned that

the length might affect the ability of elderly people and/or people in pain to use the questionnaire (Appendix i). This was to some extent confirmed by the comments from panel 3 (Appendix ii). These comments warrant a translation and cross-cultural adaption of the short version of Big Five Inventory (BFI-10) [23].

4.2 Face validity

A patient group was chosen to participate in the third panel to get an impression of how laymen with clinical conditions responded to the translated questionnaire. The questionnaire is designed to measure the five most commonly acknowledged personality traits, but it is not capable of e.g. quantifying function or severity of a physical condition. Including a group with a range of underlying clinical conditions was nevertheless considered important to secure the face validity of the questionnaire especially when considering the increasing interest in the interaction between personality and clinical conditions such as chronic pain [9].

4.3 Internal consistency, test-retest reliability and factor loadings

Surprisingly, the Cronbach's α value for agreeableness was below the desired 0.7 level (Table 2). This contrasts what has been reported in previous translations such as the Dutch [26] and Norwegian [29] versions. Nevertheless, translations into other languages have shown discrepancies in the internal consistency of the same subscale [28, 49–51]. It is unlikely that this can be related to the translation of the questionnaire as only one of the comments from panel 2 or 3 were related to this subscale (questions 7; Appendices i and ii). Removing the first question from the subscale items did improve the α level sufficiently while removing other questions did not (Table 3).

The test-retest reliability was between high and very high which is comparable to what was seen in the Italian [27] and Dutch [26] translations of the BFI.

The findings from the principal component analysis were different from what was seen previously [30] where items from two sub-scales (Agreeableness and Conscientiousness) loaded on the same factor in an almost equal manner (Appendix iii). Although the assumptions for performing the principal component analysis were met, it is likely that the study was underpowered to detect a

five-factor structure considering that it is recommended that the ratio between number of subjects per item should be between 3 and 10:1 [52–54]. Moreover, factor analyses run on a subject-item ratio similar to this study (2:1) have been shown to produce correct factor solutions in only 1 out of ten cases [55]. Considering that a five-factor structure was detected in versions translated into languages culturally and geographically similar to Denmark [28, 29], it is likely that a larger sample would be comparable to the findings in the Norwegian ($n = 389$) and German ($n = 480$) versions. This however, warrants further investigations of the construct validity of the Danish version of the BFI.

4.4 Conclusion

This is the first time the Big Five Inventory has been translated and cross-culturally adapted to the Danish language. The translated version demonstrated high to very high test-retest reliability and, for most parts, an acceptable internal consistency. The construct validity was however different from versions translated into languages geographically and culturally similar to Danish. The length of the questionnaire was a concern for laymen with and without a clinical condition, which highlights the need for a Danish version of the short version of the Big Five Inventory to increase feasibility of its use in research and clinical practice.

4.5 Implications

The current results indicate that the Danish version of the Big Five Inventory can be a useful tool for evaluating the Big Five personality traits in Danish populations. This can be valuable for many reasons e.g. when assessing people in pain. The fact that pain is a subjective experience, which can be affected by multiple domains [56] is why there is a broad consensus regarding people in pain needing to be assessed within a biopsychosocial framework [57]. Although the biopsychosocial approach is broad and inclusive, it has recently been considered inadequate, as it does not account for the dynamic nature of emotional and physical health [58, 59]. In fact, it has been suggested that certain personality traits may play a role in this dynamic relationship which may imply that the concept of a “pain personality” exists [9]. Moreover, the authors concluded that assessing personality traits might be important, especially in patients where the best available care was unhelpful.

When assessing people in pain and attempting to determine whether personality traits may contributed to their condition, it is important to note that normative values for personality do not exist. It is possible to compare individual scores to data from large populations such as those included in the German [28] or Dutch [26] translations. Here however, it needs to be acknowledged that these studies were not designed to provide normative data. Assessing personality traits in pain populations may however indicate patterns or relationships with clinical variables such as pain intensity, disability or coping strategies.

Appendix i

Outcome from panel 2 and panel 3 discussions

BFI Translation

Panel 2

Participants: Eight healthy individuals (two females)

General and specific comments

- The setup is a bit strange (the lines under the answers do not match the questions)
[opsætning er lidt mærkelig (stregerne passer ikke lige ud for spørgsmålene)]
- Too many questions, perhaps too long for older persons/persons suffering from pain
[for mange spørgsmål, måske for lang til ældre/personer i smerter]
- Questions 5 and 25: “inventive” is used in both questions
[Spørgsmål 5 + 25: “opfindsom” i begge]
- Question 7: Will everybody understand unselfish?
– perhaps an explanation would be good similar to question 24
[Spørgsmål 7: forstår alle uselvisk? – måske en forklaring som i spg. 24]
- Question 16: The sentence needs to be rephrased
[“Genererer masser af entusiasme”]

- Question 26: [Selvhævdende] is interpreted in a negative way
[Spørgsmål 26: selvhævdende opfattes i en negativ betydning]
- Question 40: To reflect and play with ideas is not necessarily the same thing
[Spørgsmål 40: “reflektere” og “lege med idéer” er ikke nødvendigvis det samme]
- Question 41: “Artistic”, the word is understood as very high-cultural
[Spørgsmål 41: “kunstnerisk”, ordet forstås som meget høj-kulturel]
- The panel doubts whether the following words can be too difficult for laymen
 - Uselvisk (question 7) – changed to “ikke selvoptaget”
 - Entusiasme (question 16) – changed to “begejstring”
 - Selvhævdende (question 26) – Formulation of sentence changed to the current version
 - Æstetiske (question 30) – changed to “kunstneriske”
 - Sofistikeret (question 44) – changed to “...stor viden inden for...”

Appendix ii

Panel 3

General and specific comments

- Difficult to understand the scoring system of the questionnaire – both because it is difficult to figure out which questions refer to which of the 5 personality traits and which numbers should be added for each personality trait. The explanations (with examples) of how to reverse the scoring. This confused the participants considerably
- The questionnaire is too long – some participants became bored before they finished the questionnaire
- Question 41: The way the question is phrased can make the word “few” [få] disappear when reading the statement. Could perhaps be re-formulated to “does not have so many artistic interests” [har ikke så mange kunstneriske interesser]

Appendix iii

Principal Component Analysis – Rotated Component Matrix						
Jeg ser mig selv som en der...		Component				
		1	2	3	4	5
Extraversion	...er snakkesalig	0.796	0.024	0.000	0.190	−0.188
	...er reserveret	0.684	−0.001	−0.219	−0.036	0.093
	...er fuld af energi	0.469	0.405	−0.050	0.287	0.032
	...skaber masse af begejstring	0.575	0.225	0.054	0.403	0.034
	...har tendens til at være stille	0.841	−0.065	−0.010	−0.020	−0.069
	...kan udtrykke sine meninger uden at krænke andre	0.179	0.492	−0.167	0.236	0.087
Aggreeableness	...er sommetider genert, hæmmet	0.618	0.007	−0.252	−0.079	0.311
	...er udadvendt, social	0.786	0.108	−0.048	0.208	0.137
	...har tendens til at finde fejl hos andre	0.771	0.027	0.082	0.260	−0.214
	...er hjælpsom og ikke selvoptaget	0.136	0.606	−0.162	0.097	−0.067
	...starter skænderier med andre	−0.216	0.341	−0.292	−0.094	0.091
	...er tilgivende af natur	−0.042	0.469	−0.288	−0.057	−0.248
Conscientiousness	...generelt er tillidsfuld	0.064	0.576	−0.099	−0.049	−0.040
	...kan være kold og reserveret	0.427	0.092	−0.055	−0.056	0.044
	...er hensynsfuld og venlig overfor næsten alle	0.023	0.688	−0.018	0.174	0.020
	...er sommetider uhøflig overfor andre	−0.019	0.426	0.001	0.107	0.295
	...kan lide at samarbejde med andre	0.433	0.275	−0.124	0.060	0.337
	...udfører et grundigt stykke arbejde	−0.064	0.712	−0.146	−0.043	−0.099
Neuroticism	...kan være lidt ubetænksom	0.013	0.353	−0.060	−0.093	0.268
	...er en pålidelig medarbejder	0.118	0.641	−0.009	0.015	−0.077
	...har tendens til at være uorganiseret	0.255	0.411	0.065	−0.207	0.409
	...har tendens til at være doven	0.272	0.424	−0.040	−0.183	0.120
	...vedholdende indtil opgaven er afsluttet	0.054	0.486	0.150	0.058	0.224
	...gør ting effektivt	0.284	0.582	0.074	0.122	0.072
Openness	...lægger planer og gennemfører dem	0.368	0.296	0.149	0.095	0.509
	...er let at distrahere	0.012	0.094	−0.206	−0.086	0.588
	...er deprimeret, trist	−0.465	−0.059	0.425	0.181	−0.164
	...er afslappet, god til at håndtere stress	−0.142	−0.015	0.752	−0.229	−0.040
	...kan være anspændt	−0.063	0.056	0.743	−0.092	−0.159
	...bekymrer sig meget	−0.014	0.026	0.701	0.161	0.003
Openness	...er følelsesmæssigt stabil, ikke let at bringe ud af fatning	−0.114	−0.136	0.616	−0.227	0.085
	...kan have svingende humør	0.016	−0.136	0.646	−0.135	−0.319
	...bevarer roen i anspændte situationer	0.003	−0.300	0.629	−0.271	0.053
	...nemt bliver nervøs	−0.166	−0.096	0.745	−0.087	0.151
	...er original, kommer på nye ideer	0.288	0.096	−0.138	0.730	−0.067
	...er nysgerrig omkring mange forskellige ting	0.151	0.141	−0.233	0.539	0.176
	...er indsigtfuld, en der tænker sig grundigt om	−0.108	0.561	−0.003	0.223	0.177
	...har en god fantasi	−0.157	0.051	0.019	0.746	0.174
	...er opfindsom	0.113	0.047	−0.132	0.843	0.010
	...værdsetter kunstneriske oplevelser	−0.025	0.081	−0.064	0.140	0.604
...foretrækker rutinearbejde	0.134	−0.361	−0.296	0.341	0.366	
...kan lide at reflektere over og lege med idéer	0.096	0.027	−0.214	0.648	0.416	
	...har få kunstneriske interesser	0.012	−0.045	0.093	0.145	0.597
	...har stor viden indenfor kunst, musik eller litteratur	−0.008	−0.074	−0.004	0.138	0.705

Appendix iii Results from a Principal Component Analysis demonstrating factor loadings and cross-loadings from the five sub-scales of the BIF from 96 subjects. Factor loadings above 0.3 are marked with **bold** as factor loadings below 0.3 are considered minimal [59].

Authors' statements

Research funding: This study was funded by the Department of Health Science and Technology, Aalborg University. Dr. Skou is currently funded by the Independent Research Fund Denmark (DFF – 6110-00045) and the Lundbeck Foundation. The funders did not have any role in this study other than to provide funding. Dr. Skou is associate editor of the Journal of Orthopaedic & Sports Physical Therapy, has received grants from The Lundbeck Foundation, personal fees from Munksgaard, all of which are outside the submitted work. He is co-founder of Good Life with Osteoarthritis in Denmark (GLA:D®), a not-for-profit initiative hosted at University of Southern Denmark aimed at implementing clinical guidelines for osteoarthritis in clinical practice. Dr. Christensen is supported by the Fund for research, quality and education in physiotherapy practice (Fysioterapipraksisfonden) and the Lundbeck Foundation for Health Care Research. The funders did not have any role in this study.

Conflict of interest: The authors have no conflict of interest to report

Informed consent: All participants in the panels were informed of the study's aims and gave their informed consent verbally after having been informed of their rights regarding to their participation. This included that their participation was voluntary and that all personal identifiable information would not be included in the data analysis. Likewise, they were informed of their right to withdraw from participation in the study and have all information about them removed from the dataset.

Ethical approval: As per guidelines from the national ethical committee in Denmark (www.nvk.dk), studies focusing on translation of questionnaires do not require a formal evaluation by the regional ethical committee.

References

- [1] Afshar H, Roohafza HR, Keshteli AH, Mazaheri M, Feizi A, Adibi P. The association of personality traits and coping styles according to stress level. *J Res Med Sci* 2015;20:353–8.
- [2] Asghari A, Nicholas MK. Personality and pain-related beliefs/ coping strategies: a prospective study. *Clin J Pain* 2006;22: 10–8.
- [3] Klein DN, Kotov R, Bufferd SJ. Personality and depression: explanatory models and review of the evidence. *Annu Rev Clin Psychol* 2011;7:269–95.
- [4] Sadock BJ, Sadock VA, Ruiz P. Kaplan & Sadock's comprehensive textbook of psychiatry, 10th ed. Philadelphia: Lippincott Williams & Wilkins (LWW), 2017:4997.
- [5] Costa P, McCrea R. The Five-Factor Model of personality and its relevance to personality disorders. *J Pers Disord* 1992;6:343–59.
- [6] De Raad B. The Big Five personality factors: the psycholexical approach to personality. Ashland, OH, USA: Hogrefe & Huber Publishers, 2000: vii, 128-vii, p.
- [7] Terracciano A, Sutin AR, An Y, O'Brien RJ, Ferrucci L, Zonderman AB, Resnick SM. Personality and risk of Alzheimer's disease: new data and meta-analysis. *Alzheimers Dement* 2014;10:179–86.
- [8] Lefebvre JC, Keefe FJ. The effect of neuroticism on the recall of persistent low-back pain and perceived activity interference. *J Pain* 2013;14:948–56.
- [9] Naylor B, Boag S, Gustin SM. New evidence for a pain personality? A critical review of the last 120 years of pain and personality. *Scand J Pain* 2017;17:58–67.
- [10] Gustin SM, Burke LA, Peck CC, Murray GM, Henderson LA. Pain and personality: do individuals with different forms of chronic pain exhibit a mutual personality? *Pain Pract* 2016;16:486–94.
- [11] Kim SY, Kim JM, Stewart R, Kang HJ, Kim SW, Shin IS, Park MS, Cho KH, Yoon JS. Influences of personality traits on quality of life after stroke. *Eur Neurol* 2013;69:185–92.
- [12] Clark JM, Cao Y, Krause JS. Risk of pain medication misuse after spinal cord injury: the role of substance use, personality, and depression. *J Pain* 2017;18:166–77.
- [13] Vlaeyen JW, Linton SJ. Are we “fear-avoidant”? *Pain* 2006;124:240–1.
- [14] Adriana B, Ana M, Marijana B, Livia P, Ivana K, Caroline H, Ozren P. Neuroticism and pain catastrophizing aggravate response to pain in healthy adults: an experimental study. *Korean J Pain* 2018;31:16–26.
- [15] Burri A, Ogata S, Rice D, Williams F. Pain catastrophizing, neuroticism, fear of pain, and anxiety: defining the genetic and environmental factors in a sample of female twins. *PLoS One* 2018;13:e0194562.
- [16] Weisberg JN. Personality and personality disorders in chronic pain. *Curr Rev Pain* 2000;4:60–70.
- [17] Fishbain DA, Cole B, Cutler RB, Lewis J, Rosomoff HL, Rosomoff RS. Chronic pain and the measurement of personality: do states influence traits? *Pain Med* 2006;7:509–29.
- [18] Lenzenweger MF. Stability and change in personality disorder features: the Longitudinal Study of Personality Disorders. *Arch Gen Psychiatry* 1999;56:1009–15.
- [19] Hampson SE, Goldberg LR. A first large cohort study of personality trait stability over the 40 years between elementary school and midlife. *J Pers Soc Psychol* 2006;91:763–79.
- [20] John OP, Naumann LP, Soto CJ. Paradigm shift to the integrative Big Five trait taxonomy: History, measurement, and conceptual issues. *Handbook of personality: Theory and research*, 3rd ed. New York, NY, US: Guilford Press, 2008:114–58.
- [21] John OP, Srivastava S. The Big Five Trait taxonomy: history, measurement, and theoretical perspectives. In: Pervin LA, John OP, editors. *Handbook of personality: theory and research*. New York: Guilford Press, 1999:102–38.
- [22] McCrae RR, Costa PT, Jr. Validation of the five-factor model of personality across instruments and observers. *J Pers Soc Psychol* 1987;52:81–90.
- [23] Rammstedt B, John OP. Measuring personality in one minute or less: a 10-item short version of the Big Five Inventory in English and German. *J Res Pers* 2007;41:203–12.
- [24] Soto C, John O. Short and extra-short forms of the Big Five Inventory-2: the BFI-2-S and BFI-2-XS. *J Res Pers* 2017;68:69–81.

- [25] Soto CJ, John OP. The next Big Five Inventory (BFI-2): developing and assessing a hierarchical model with 15 facets to enhance bandwidth, fidelity, and predictive power. *J Pers Soc Psychol* 2017;113:117–43.
- [26] Denissen JJ, Geenen R, van Aken MA, Gosling SD, Potter J. Development and validation of a Dutch translation of the Big Five Inventory (BFI). *J Pers Assess* 2008;90:152–7.
- [27] Ubbiali A, Chiorri C, Hampton P, Donati D. Italian Big Five Inventory. Psychometric properties of the Italian adaptation of the Big Five Inventory (BFI). *Appl Psychol Bull* 2013;266:37–48.
- [28] Lang F, Lüdtke O, Asendorpf J. Testgüte und psychometrische Äquivalenz der deutschen Version des Big Five Inventory (BFI) bei jungen, mittelalten und alten Erwachsenen [Validity and psychometric equivalence of the German version of the Big Five Inventory in young, middle-aged, and old adults]. *Diagnostica* 2001;47:111–21.
- [29] Engevik H. [The Big Five Inventory in Norwegian]. *Tidsskrift for Norsk psykologforening* 2005;42:128–9.
- [30] Schmitt DP, Allik J, McCrae RR, Benet-Martínez V. The geographic distribution of Big Five Personality Traits: patterns and profiles of human self-description across 56 nations. *J Cross Cult Psychol* 2007;38:173–212.
- [31] Kottner J, Audige L, Brorson S, Donner A, Gajewski BJ, Hrobjartsson A, Roberts C, Shoukri M, Streiner DL. Guidelines for Reporting Reliability and Agreement Studies (GRRAS) were proposed. *J Clin Epidemiol* 2011;64:96–106.
- [32] Acquadro C, Conway K, Hareendran A, Aaronson N. Literature review of methods to translate health-related quality of life questionnaires for use in multinational clinical trials. *Value Health* 2008;11:509–21.
- [33] Swaine-Verdier A, Doward LC, Hagell P, Thorsen H, McKenna SP. Adapting quality of life instruments. *Value Health* 2004;7 Suppl 1:S27–30.
- [34] Malterud K, Siersma VD, Guassora AD. Sample size in qualitative interview studies: Guided by information power. *Qual Health Res* 2015;26:1753–60.
- [35] Riel H, Jensen MB, Olesen JL, Rathleff MS. Translation and cultural adaptation of a Danish version of the Foot Health Status Questionnaire for individuals with plantar heel pain. *Foot* 2019;38:61–4.
- [36] van Genderen S, Plasqui G, Lacaille D, Arends S, van Gaalen F, van der Heijde D, Heuft L, Keszei A, Luime J, Spoorenberg A, Landewe R, Gignac M, Boonen A. Social Role Participation Questionnaire for patients with ankylosing spondylitis: translation into Dutch, reliability and construct validity. *RMD Open* 2016;2:e000177.
- [37] Schwaba T, Bleidorn W. Individual differences in personality change across the adult life span. *J Pers* 2018;86:450–64.
- [38] Srivastava S, John OP, Gosling SD, Potter J. Development of personality in early and middle adulthood: set like plaster or persistent change? *J Pers Soc Psychol* 2003;84:1041–53.
- [39] Zhang G, Li J, Liu D, Wang T, Wang Y, Xu W. Translation and validation of the Chinese Social Role Participation Questionnaire in patients with ankylosing spondylitis. *Clin Rheumatol* 2018;37:655–60.
- [40] Hansen AØ, Knygsand-Roehoej K, Ardensø K. Danish version of the Patient-Rated Wrist/Hand Evaluation questionnaire: translation, cross-cultural adaptation, test–retest reliability and construct validity. *Hand Therapy* 2018;24:22–30.
- [41] Nunnally JC, Bernstein IH. *Psychometric theory*, 3rd ed. New York: McGraw-Hill, Inc., 1994.
- [42] de Vet HCW, Terwee CB, Mokkink LB, Knol DL. *Measurement in medicine: a practical guide*. Cambridge: Cambridge University Press, 2011.
- [43] Terwee CB, Bot SD, de Boer MR, van der Windt DA, Knol DL, Dekker J, Bouter LM, de Vet HC. Quality criteria were proposed for measurement properties of health status questionnaires. *J Clin Epidemiol* 2007;60:34–42.
- [44] Plichta SB, Kelvin EA, Munro BH. *Munro's statistical methods for health care research*. Philadelphia, PA: Wolters Kluwer Health/Lippincott Williams & Wilkins, 2013.
- [45] de Vet HCW, Terwee CB, Knol DL, Bouter LM. When to use agreement versus reliability measures. *J Clin Epidemiol* 2006;59:1033–9.
- [46] Tabachnick BG, Fidell LS. *Using multivariate statistics*, 6th ed. Mosher J, editor. New Jersey: Pearson Education Inc., 2012.
- [47] Hagell P, Hedin PJ, Meads DM, Nyberg L, McKenna SP. Effects of method of translation of patient-reported health outcome questionnaires: a randomized study of the translation of the Rheumatoid Arthritis Quality of Life (RAQoL) Instrument for Sweden. *Value Health* 2010;13:424–30.
- [48] Lee WL, Chinna K. The forward-backward and dual-panel translation methods are comparable in producing semantic equivalent versions of a heart quality of life questionnaire. *Int J Nurs Pract* 2019;25:e12715.
- [49] Benet-Martínez V, John OP. Los Cinco Grandes across cultures and ethnic groups: multitrait multimethod analyses of the Big Five in Spanish and English. *J Pers Soc Psychol* 1998;75:729–50.
- [50] Lovik A, Nassiri V, Verbeke G, Molenberghs G, Södermans AK. Psychometric properties and comparison of different techniques for factor analysis on the Big Five Inventory from a Flemish sample. *Pers Individ Dif* 2017;117:122–9.
- [51] Carciofo R, Yang J, Song N, Du F, Zhang K. Psychometric evaluation of Chinese-language 44-Item and 10-Item Big Five Personality Inventories, including correlations with chronotype, mindfulness and mind wandering. *PLoS One* 2016;11:e0149963.
- [52] Everitt BS. Multivariate analysis: the need for data, and other problems. *Br J Psychiatry* 1975;126:237–40.
- [53] Cattell RB. *The scientific use of factor analysis in behavioral and life sciences*, 1st ed. New York: Plenum Press, 1978.
- [54] Gorsuch RL. *Factor analysis*, Classic Edition. 2nd ed. New York and London: Routledge – Taylor & Francis Group, 2015.
- [55] Costello AB, Osborne J. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Pract Assess Res Eval* 2005;10:1–9.
- [56] Dansie EJ, Turk DC. Assessment of patients with chronic pain. *Br J Anaesth* 2013;111:19–25.
- [57] Lumley MA, Cohen JL, Borszcz GS, Cano A, Radcliffe AM, Porter LS, Schubiner H, Keefe FJ. Pain and emotion: a biopsychosocial review of recent research. *J Clin Psychol* 2011;67:942–68.
- [58] Lehman BJ, David DM, Gruber JA. Rethinking the biopsychosocial model of health: understanding health as a dynamic system. *Soc Personal Psychol Compass* 2017;11:e12328.
- [59] Stilwell P, Harman K. An enactive approach to pain: beyond the biopsychosocial model. *Phenomenology and the Cognitive Sciences* 2019;18:637–65.